This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (currently amended) A method of determining an overlay error between two layers of a multiple layer sample, the method comprising:

for a plurality of periodic targets that each have a first structure formed from a first layer and a second structure formed from a second layer of the sample, employing an interferometer to modulate substantially a plurality of wavelengths of a broadband source and then acquiring one or more images of the periodic targets, wherein there are predefined offsets between the first and second structures; and

determining and storing an overlay error between the first and second structures by analyzing the one or more acquired images from the periodic targets using a scatterometry overlay technique based on the predefined offsets.

2. (original) A method as recited in claim 1, wherein the one or more images are analyzed pixel by pixel.

3. (original) A method as recited in claim 1, wherein the one or more images are analyzed by analyzing groups of pixels together.

4. (original) A method as recited in claim 1, wherein the interferometer is a Michelson or a Linnik interferometer.

5. (original) A method as recited in claim 1, wherein the analysis of the one or more images includes applying a discrete Fourier transform for a signal recorded for each pixel or group of pixels of the one or more images for each target to obtain a spectral profile for each target.

6. (original) A method as recited in claim 5, wherein the analysis of the one or more images further includes determining a linear dependence of the overlay error based on the spectral profile for each target and determining the overlay error based on such linear dependence.

7. (original) A method as recited in claim 5, wherein the analysis of the one or more images further includes determining a periodic function of the overlay error based on the spectral profile for each target and determining the overlay error based on such periodic function.

8. (original) A method as recited in claim 1, wherein the interferometer includes a polarizer in an incident path.

9. (original) A method as recited in claim 8, wherein the interferometer includes a polarization analyzer in a collection path.

10. (original) A method as recited in claim 1, wherein each first structure has a first center of symmetry and each second structure has a second center of symmetry and wherein the first center of symmetry and the second center of symmetry for each target are offset with respect to each other by a selected one of the predefined offsets.

11. (original) A method as recited in claim 1, wherein the overlay error is determined without comparing the measured optical signals to calibration data.

12. (original) A method as recited in claim 1, wherein the scatterometry overlay technique is a linear based technique.

13. (original) A method as recited in claim 1, wherein the scatterometry overlay technique is a phase based technique.

14. (currently amended) A method of determining an overlay error between two layers of a multiple layer sample, the method comprising:

for a plurality of theoretical overlay errors and a plurality of target configurations and/or process conditions ~~and/or overlay errors~~, generating a plurality of theoretical scatterometry signals on the plurality of target configurations using a model or calibrated data;

storing the plurality of theoretical scatterometry signals and their associated theoretical overlay errors and target configurations and/or process conditions ~~and/or overlay errors~~;

for each of a plurality of measured periodic targets that each have a first structure formed from a first layer and a second structure formed from a second layer of the sample, measuring an optical signal, wherein there are predefined offsets between the first and second structures;

determining a measured overlay error between the first and second structures by analyzing the measured optical signals ~~at the plurality of incident angles~~ from the periodic targets using a scatterometry overlay technique based on the predefined offsets without using a calibration operation; and

comparing the measured scatterometry signal with the stored ~~measured~~ theoretical scatterometry signals to obtain and store a characteristic of the measured periodic targets' configuration or process condition for such measured periodic targets based on a substantially matching theoretical overlay ~~value~~ error and measured overlay error.

15. (original) A method as recited in claim 14, wherein each first structure has a first center of symmetry and each second structure has a second center of symmetry and wherein the first center of symmetry and the second center of symmetry for each target are offset with respect to each other by a selected one of the predefined offsets.

16. (original) A method as recited in claim 14, wherein the overlay error is determined without comparing the measured optical signals to calibration data.

17. (original) A method as recited in claim 14, wherein the scatterometry overlay technique is a linear based technique.

18. (original) A method as recited in claim 14, wherein the scatterometry overlay technique is a phase based technique.

19-23. (cancelled)

24. (currently amended) A method for determining an overlay error between at least two layers in a multiple layer sample, the method comprising:

(a) using an optical system to measure a plurality of measured optical signals from a plurality of periodic targets on the sample, wherein the periodic targets each have a first structure in a first layer and a second structure in a second layer, wherein there are predefined offsets between the first and second structures, wherein the optical signals are measured at a same focus setting of the optical system without refocusing; ~~and~~

(b) using a scatterometry overlay technique to analyze the measured optical signals of the periodic targets and the predefined offsets of the first and second structures of the periodic targets to thereby determine and store an overlay error between the first and second structures of the periodic targets; and

for a second plurality of periodic targets, repeating operations (a) and (b) for a second focus setting wherein the optical signals are measured at the same second focus setting of the optical system without refocusing.

25. (cancelled)

26. (currently amended) A method as recited in claim 24 ~~claim 25~~, wherein the first focus setting is optimized for the first set of periodic targets and the second focus setting is optimized for the second set of periodic targets.

27. (original) A method as recited in claim 26, wherein the first set of periodic targets has a different orientation than the second set of periodic targets.

28. (original) A method as recited in claim 24, wherein each first structure has a first center of symmetry and each second structure has a second center of symmetry and wherein the first center of symmetry and the second center of symmetry for each target are offset with respect to each other by a selected one of the predefined offsets.

29. (original) A method as recited in claim 24, wherein the overlay error is determined without comparing the measured optical signals to calibration data.

30. (original) A method as recited in claim 24, wherein the scatterometry overlay technique is a linear based technique.

31. (original) A method as recited in claim 24, wherein the scatterometry overlay technique is a phase based technique.

32. (currently amended) A method for determining an overlay error between at least two layers in a multiple layer sample, the method comprising:

using an optical system to measure a plurality of measured optical signals from a plurality of periodic targets that each have a first structure formed from a first layer and a second structure formed from a second layer on the sample, wherein each first and second structure of each target are designed to have a predefined offset with respect to each other;

using a scatterometry overlay technique to analyze the measured optical signals of the periodic targets and the predefined offsets of the first and second structures of the periodic targets to thereby determine and store a first overlay error between the first and second structures of the periodic targets; and

using a model based technique to analyze the measured optical signals of the periodic targets to thereby determine a second overlay error between the first and second structures of the periodic targets,

wherein the model based technique is based on the first overlay error.

33. (cancelled)

34. (original) A method as recited in claim 32, further comprising comparing the first and second overlay errors and adjusting the model based technique based on the comparison if there is a significant difference between the first and second overlay errors.

35. (original) A method as recited in claim 32, wherein each first structure has a first center of symmetry and each second structure has a second center of symmetry and wherein the first center of symmetry and the second center of symmetry for each target are offset with respect to each other by a selected one of the predefined offsets.

36. (currently amended) A method as recited in claim 32, wherein the first overlay error is determined without comparing the measured optical signals to calibration data.

37. (original) A method as recited in claim 32, wherein the scatterometry overlay technique is a linear based technique.

38. (original) A method as recited in claim 32, wherein the scatterometry overlay technique is a phase based technique.

39. (currently amended) A method for aligning an imprint lithography mask with a semiconductor wafer, the method comprising:

(a) aligning a plurality of periodic alignment marks of the mask with a plurality of alignment marks on the wafer;

(b) using an optical system to measure a plurality of measured optical signals from a plurality of the periodic alignment marks on the mask and on the wafer, wherein the periodic alignment marks each have a first structure in a first layer and a second structure in a second layer, wherein there are predefined offsets between the first and second structures;

(c) using a scatterometry overlay technique to analyze the measured optical signals of the periodic alignment marks and the predefined offsets of the first and second structures of the periodic alignment marks to thereby determine and store an overlay error or mask registration error between the mask and the wafer; and

(d) repeating operations (a) through (c) until the overlay error or mask registration error equals a predetermined offset or is within a predetermined range of mask misregistration values.

40. (original) A method as recited in claim 39, wherein the predetermined offset is substantially zero.

41. (original) A method as recited in claim 39, wherein each first structure has a first center of symmetry and each second structure has a second center of symmetry and wherein the first center of symmetry and the second center of symmetry for each target are offset with respect to each other by a selected one of the predefined offsets.

42. (original) A method as recited in claim 39, wherein the overlay error is determined without comparing the measured optical signals to calibration data.

43. (original) A method as recited in claim 39, wherein the scatterometry overlay technique is a linear based technique.

44. (original) A method as recited in claim 39, wherein the scatterometry overlay technique is a phase based technique.